ENGINE LUBRICATION

Gasoline and oil engines are lubricated almost automatically at low and high speeds during winter and summer, provided they are supplied with the correct grade of oil; operated at "summer heat" temperature; and the engine and oil are kept clean.

Whenever an engine operates on any type of fuel, water vapour is formed in the exhaust gas. A gallon of gasoline weighs 7·4 pounds, and forms 9·2 pounds of water as it is burned in the engine. All of the water must be carried out of the engine as superheated steam, if damage is to be avoided. Unfortunately, considerable quantities of exhaust gas blow by the pistons into the crank case; more when the engine is cold than when hot; also more when the engine is worn than when new. Consequently, warm storage; the right temperature thermostat; radiator shutters; crank case ventilation; crank case covers; medium high speed engine operation when starting; or any practice which will quickly warm the engine and crank case up above the dew point of water vapour (122° F.), will reduce the quantity of water vapour which mixes with the oil.

Probably 70 per cent of engine wear occurs during the warming up period of no lubrication. The time varies with the engine and the temperature of the oil when starting from 10,000 to 50,000 crank revolutions. This may mean from 10 to 30 min. for the automobile and from 10 to 50 min. for the tractor.

Putting new rings into cylinders which are out of round increases the "blow-by" of exhaust gas into the crank case, materially increasing the formation of water sludge and corrosion.

Top lubrication, using a medium-heavy oil, S.A.E. 30-40 in the summer, and S.A.E. 10-20 in the winter, added at the rate of 2·2 per cent to the gasoline, reduces the wear of the cylinders at the ratio of 4-1, and the top ring 3-1. The above grades of oil settled out of the fuel air mixture onto the cylinders and rings much better than the lighter fine oils or spindle oils.

Experience in Western Canada has shown that a pint of oil to ten gallons of gasoline does not affect the starting and idling characteristics of the carburetor and engine. It does not foul the engine in any way or affect the condition of the valves. The engine has a tendency to operate more silently and to wear much less. Where the oil is kept clean and oil in the gasoline is used the wear of the cylinders and rings which causes oil pumping, and makes reboring necessary, has been reduced to such a point that 3 to 4 times the ordinary mileage was obtained before reboring was necessary.

Top lubrication consisting of one pint of oil to five gallons of gasoline is of particular importance to the tractor. The tractor is started on gasoline and

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should be equipped with a tank to provide for at least 20 minutes of operation with oil in the gasoline. The engine will then be warmed up and the oil in the crank case will be warmed and distributed so that the engine may be switched safely to straight gasoline or distillate. Top lubrication will also lengthen the life of piston rings and cylinders and reduce oil consumption to a greater proportion than the extra cost of the oil in the fuel. The cost of top lubrication can be reduced by straining or settling the used crank case oil and using it in the fuel.

Dust and Dirt.—The internal combustion engine is not only operated under varying temperature conditions but also under very unfavourable atmospheric conditions. The air is frequently filled with dust and dirt. The oil bath air strainer has been developed to protect the engine from the abrasion caused by grit in the air. The air strainer should be serviced regularly and maintained in good condition. The grit from the air also goes into the crank case of the engine through the breather and crank case ventilation systems where the cleaners on these systems are not present or properly cared for. Where oil filters are not present in the oil distribution system the oil should be drained much more frequently. The oil should be drained every 500 to 1,000 miles for the automobile and every day or so for the tractor not fitted with a filter.

Lubricating oil does not wear out. It becomes contaminated with dust, grit, carbon and water which makes it no longer suitable for engine lubrication. The oil must be drained to remove this contamination.

Drained Crank Case Oil is not a good lubricant for farm machinery or a satisfactory oil for painting buildings. It is only valuable after it has been cleaned when it may be used as oil in the fuel for top lubrication or put back in the crank case of the engine for engine lubrication.

When a tractor without a filter is operated in dusty service the oil should be drained every day and strained through two or three thicknesses of heavy canton cotton, or allowed to settle out, in order that the grit may be removed from the oil. The oil may be placed in a container where it will be warm and the dirt settled out if it is not convenient to strain out the dirt. It may take a week or so to settle out the dirt, but keeping the oil hot will hasten separation. It is extremely important that the air and oil be clean if engine lubrication is to be had with minimum wear.

Oil Filters.—The oil filter is designed to clean the dirt, carbon, metal and water from the oil as it collects from the air and engine during operation. The use of the oil filter should extend the usefulness of each oil filling as well as prevent the circulation of the dirt through the engine lubrication system.

Filtering elements include fine cotton waste, felt, canton cotton, crepe paper, and various mixtures of clay. Some of the filtering elements are supplemented by a hot tube for the purpose of evaporating the water.

The filtering elements must be replaced or repacked whenever the oil becomes dirty. Filters may need replacing frequently under adverse operating conditions, and less often when operation is in the summer under dust-free conditions. The cost of the filter element for replacement should be considered when purchasing a filter.

The condition of the oil may be determined by placing several drops of oil from the crank case, using the bayonet gauge, upon blotting paper. The presence of dirt or carbon particles will indicate the condition of the oil, and whether it is time to replace the filtering element.

The practice of operating for long periods without draining the oil may be dangerous in engines fitted with the copper lead type precision bearings, and also with aluminum pistons. This is particularly true when operating in the colder weather of fall, winter, and spring, rather than in summer.

Corrosion results from the fact that oils become acid from long periods of operation, and acidity tends to stimulate corrosion, particularly during cold operation. Some oil filters claim to remove the acidity, and some crank case ventilation removes portions of the acidity. However, the only sure way is to drain the oil from the crank case periodically. When the oil is settled so that all of the sediment has accumulated into the bottom, the acidity will be in the sediment, and the oil can be poured off and used again.

Diesel Engine Lubrication.—Automotive and tractor Diesel engines are lubricated by the full pressure crank case system of lubrication, similar to the automobile and tractor engines. The oil must be clean and changed similarly to the gasoline engine.

The fuel injection pump of the Diesel engine is lubricated by the fuel, which must be sufficiently viscous (35 sec. at 100° F.) to lubricate, and must also be free from dirt or grit which would wear the pump.

The Diesel engine operates somewhat cooler than the gasoline engine. There is some free carbon formed during the operation of the Diesel which mixes with the lubricating oil on the cylinders, pistons and rings. The carbon must be carried from the pistons and rings into the crank case by the lubricant.

The oil used in the Diesel engine is a high grade of oil. There are compounded oils designed especially for the lubrication of the Diesel engine.

Where a special oil is recommended by the Diesel engine manufacturer in order to obtain special lubricating characteristics, such oil should be used. Experience has shown that any oil which will carry the carbon from the rings into the crank case has been satisfactory. Where the instructions of the Diesel engine manufacturers are followed there will be no difficulty in lubricating the Diesel engine for efficient operation.

Compounded Oils.—Oils have been compounded to improve the material quality of a lubricant by adding a cleansing property to the oil. Compounded oils were developed for Diesel engines primarily. However, research has shown that, for heavy duty service in the gasoline engine, the characteristics of the well balanced compounded oil improve lubrication by maintaining a cleaner engine between oil draining periods.

When used in engines which have been operated with some oils which permit accumulations of dirt and sludge in the engine, the oil should be drained frequently to prevent loosened deposits from clogging the pump strainer or oil passages, as well as the oil filter. The oil pressure should be watched carefully during this period.

The oil, when drained, will be black, filled with loosened carbon, dirt and sludge. The oil should be drained while hot. The engine should be flushed out with flushing oil, and the oil filter cartridge replaced with a new one, after which the engine should be filled with oil of the recommended S.A.E. No.

The standard oil filters do not remove the compounds in the oil. The oil should be drained as recommended by the engine builders, rather than using the colour of the oil as an indication of the draining period. Most compounded oils become black with use, because of the presence of minute carbon and sludge forming materials.

Excessive Oil Consumption.—Excessive oil consumption is due to high engine speed, to cylinder and piston ring wear, or to stuck piston rings. Oil consumption can be partially controlled by using a heavier oil. However, when running on long trips the heavy oil heats to a point where oil consumption is still excessive. The only permanent remedy is to rebore the engine cylinders and put in new pistons and rings, or in the case of the tractor, put in new cylinder liners and pistons. The practice of putting in new rings in badly worn cylinders is not satisfactory. If new rings are put in as soon as an increase in oil consumption is noted, before the cylinders become noticeably out of round, considerable reduction in oil consumption will result.

Grades of Oil for the Automobile and Truck Engines.—The engine oil recommendations of one automobile manufacturer for 1938 are as follows: "The use of S.A.E. 20-W oil, rather than heavy body oils during the summer months, will permit better all round performance of the engine, with no appreciable increase in oil consumption. S.A.E. 30 may be used where temperatures run consistently above 90° F. or for consistent high speed operation where oil economy may otherwise be effected."

As low as 10° F.....S.A.E. 20-W
As low as –10° F.....S.A.E. 10-W
Below –10° F.....S.A.E. 10-W + 10% kerosene

The above recommendations have resulted from research and practice. The recommendations are typical of those for all automobiles and trucks.

Grades for Tractor Engines.—Practically the same grades of oils are recommended for tractor engines, equipped with systems similar to the automobile. The recommendations of the tractor companies, as outlined in the instruction book with regard to lubrication for the tractor engine, should be very carefully followed in every instance. Practically every tractor manufacturer deals specifically with engine lubrication.

The splash circulation, pressure mist and full pressure systems require S.A.E. No. 20 when new, S.A.E. No. 30 for ordinary operation and S.A.E. No. 40 when the engine becomes a little more worn. If the engine is worn sufficiently to cause excessive oil consumption so that S.A.E. No. 50 is needed, the engine should be overhauled. S.A.E. No. 10 or 20 should be used in winter or else the S.A.E. No. 30 oil should be heated before being put into the engine.

Winter Lubrication.—Much wear due to corrosion takes place during winter operation. Short distance running during which it is not possible for the engine to warm up to temperatures of "summer heat" is largely responsible for the excessive engine wear.

The water between the rings and pistons, particularly in the case of the aluminum piston, becomes acid, causing excessive decomposition of the piston from electrolysis, as well as corrosion. Corrosion is also excessive between the piston pins and the piston bosses. The piston pins become badly blackened and corroded and the aluminum pistons bosses seriously decomposed. The water which condenses in the crank case results from the exhaust gas blow-by past the pistons. The water vapour of the exhaust gas is condensed and is mixed with the oil whenever the crank case is cold. The water and oil mixture forms a sludge which freezes over the strainer of the oil pump, eventually stopping oil circulation and preventing proper lubrication. Water-oil sludges frequently must be heated in order to be drained from the engine. They often become so thick that some flushing oil is required to remove the sludge.

The addition of anti-freeze mixtures to the oil in an attempt to prevent the water from freezing and stopping the action of the oil pump is not recommended. While the freezing may be prevented the anti-freeze may cause the valves to stick, a coating to form inside the lubricating system exposed to heat, and corrosion will result.

Water-oil sludges in the crank case may be practically eliminated by reboring an engine whenever the clearance between pistons and cylinders is sufficient to permit excessive exhaust gas blow-by. Top lubrication supplied by either a suitable top oiler or oil in the gasoline assists in preventing blow-by by forming an oil seal between the cylinders and rings as soon as the engine is started. Top lubrication also prevents corrosion of the cylinders, rings and pistons to a large extent during the warming up period, by coating the metal parts with fresh oil from the fuel.

Western Agricultural Engineering Committee.

OTTAWA: Printed by EDMOND CLOUTIER, Printer to the King's Most Excellent Majesty, 1943.